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ABSTRACT

This study concerns determining whether three types of advance organizers (visual, audio, or written) had any effect upon learning a biological concept as measured by a constructed achievement test and whether advance organizers are more effective across learner variables of I.Q., abstract reasoning and sex. One hundred twenty randomly selected seventh-grade students were stratified on the basis of I.Q. scores and assigned to one of four treatment groups which included an audio advance organizer group, a visual organizer group, a written organizer group and a control. The constructed testing instrument was a 30-item multiple choice test and ANOVA was used to analyze the results. The results indicated that the use of advance organizers did not significantly affect the learning of the biological concept and that no interactive effects of I.Q., abstract reasoning or sex differences had any effect upon treatment. Subjective data obtained in interviews indicated that advance organizers presumably facilitate the learning of the biological concepts. (Author/BR)

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The Effects of Utilizing Three Types of Advance Organizers for Learning a Biological Concept in Seventh Grade Science

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THE EFFECTS OF UTILIZING THREE TYPES OF ADVANCE ORGANIZERS FOR LEARNING A BIOLOGICAL CONCEPT IN SEVENTH GRADE SCIENCE

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Rationale for the Study

This investigation was designed to determine the effects that three types of advance organizers had upon the learning of a biological concept in seventh grade science as measured by an achievement test on a biological concept, and to determine whether the student variables of I.Q., abstract reasoning, and sex had any effect upon learning of a biological concept when utilizing three types of advance organizers.

The need for this research was based on the premise that accelerated development of scientific knowledge and the need for teaching ideas and concepts which have survival value (Hurd, 1964) have raised questions concerning the need for economy in learning and the avoidance of teaching unnecessary and obsolete material in the science classroom. The advance organizer appears to be a meaningful organizational tool for the aforementioned purposes. Despite numerous investigations developed which give support to Ausubel's (1963) Theory of Meaningful Verbal Learning and the use of advance organizers, there appears to be nebulous and inconclusive research regarding the utilization of the advance organizer as a "means" of teaching meaningful science materials.

Recent studies by Pella and Trienzenberg (1969) and Weisburg (1970) have suggested that different types of advance organizers provide an avenue for greater achievement in learning science while others such as Brovey (1970) and Malone (1971) using visual as well as verbal advance organizers indicated that no significant differences existed when different types of advance organizers are used.

Also, some evidence has been suggested that the effect of the advance organizer may be related to specific learner characteristics. (Fitzgerald and Ausubel, 1963).

Ausubel (1963,1967) never identifies what learner characteristics contribute to utilizing the advance organizer in learning but he does suggest that learner variables of I.Q., age, etc. will effect the meaningfulness of materials presented.

Statement of the Problem

This study represents an attempt to test the effectiveness of the advance organizer as a method of teaching. Specifically, this research attempted to (1) determine whether utilizing three types of advance organizers (visual, audio, or written) had any effect upon learning a biological concept as measured by an investigator -- constructed achievement test and (2) to test whether advance organizers are more effective across learner variables of I.Q., abstract reasoning, and sex.

Experimental Design

Major Hypothesis

HO: There is no significant difference in achievement among groups which differ in the type of advance organizer recieved, be it audio, visual or written, as measured by an achievement test on a biological concept.

Sub-Hypotheses

H1: There is no significant difference in achievement between groups for high, medium, and low I.Q. groups using advance organizers and those not using advance organizers as measured by an achievement test on a biological concept.

H2: There is no significant interaction between intelligence scores for groups utilizing advance organizers and those not using advance organizers as measured by an achievement test on a biological concept.

H3: There is no significant difference in achievement for high, medium, and low abstract reasoning groups using advance organizers and groups not using advance organizers as measured by an achievement test on a biological concept.

H4: There is no significant interaction between abstract reasoning scores for groups using advance organizers and those not using advance organizers as measured by an achievement test on a biological concept.

H5: There is no significant difference in achievement between sexes for groups using advance organizers and those not using advance organizers as measured by an achievement test on a biological concept.

H6: There is no significant interaction between sexes for groups utilizing advance organizers and those not using advance organizers as measured by an achievement test on a biological concept.

Treatment

The sample was selected from 196 seventh grade students in a middle school in northwestern Pennsylvania. Assignment to treatment groups was random and stratified on the basis of I.Q. (See Table I and Table II).

To provide equal numbers within each cell of the research design, 120 pupils were randomly selected to comprise the sample used in the analysis of the results. Treatment groups included an audio advance organizer group, a visual advance organizer group, a written advance organizer group, and a control. Prior to instruction, each of these treatment groups were given an Academic Promise Test to measure abstract reasoning ability, and a California Short-Form Mental Maturity Test to measure I.Q.

Instruction included the presentation of an advance organizer (audio, visual, or written) prior to the reading of an instructional passage that portrayed in detail, the concept, "Interdependence of Living Things and Energy Transformation." The control group's instructional program was consistant with the experimental group, but in lieu of an advance organizer, a historical passage was presented. Instruction was one hour in length during the school day, and consisted of individualized teaching. Treatment period was four weeks in length. Following instruction, an investigator -- designed achievement test on the concept portrayed was administered. Scores of the achievement test were statistically analyzed by use of an analysis of variance. Treatment, I.Q., abstract reasoning, and sex comprised the four factors investigated. Achievement scores were used for the statistical analyses to test if significant differences existed between experimental and control groups. Subjective data were also obtained by way of personal interviews with the subject, and also autobiographical sketches written by the subjects.

Findings

The results of the study indicated that the use of three types of advance organizers did not significantly effect the learning of a biological concept in seventh grade science, (See Table III) and that no interactive effects of I.Q., abstract reasoning, and sex were found (See Tables IV, V, VI). Therefore it was concluded that the experimental treatment was not more effective than the control, and that the student variables of I.Q., abstract reasoning, and sex had no effect upon treatment. It was found that high, medium, and low I.Q. groups and high, medium, and low abstract reasoning groups scored consistently with their abilities regardless of the treatment used.

From subjective data obtained in interviews and autobiographical sketches, it appeared that advance organizers presumably facilitated learning of the biological concept, and that previous science experiences of the subjects

influenced their knowledge of the advance organizers.

Conclusions

In general the findings of the study were as follows:

1. That the differences in the post-test total achievement scores for audio, visual, and written advance organizer groups were not significant at the .05 level of confidence when compared to a control group not using an advance organizer.

2. That the difference in the post-test total achievement scores were not significant (at the .05 level) between experimental groups; that is, audio compared with visual, audio compared with written, visual compared with written.

3. That subjects with varying I.Q. scores (high, medium, and low) will achieve in accordance with their I.Q. scores regardless of type of treatment used.

4. That the experimental treatment was not more effective with one treatment group than another since the difference in post-test achievement scores due to the treatment interaction with I.Q. scores was not significant at the .05 level of confidence.

5. The subjects with varying abstract reasoning scores (high, medium, and low) will achieve in accordance with their abstract reasoning scores regardless of type of treatment used.

6. That the experimental treatment was not more effective with one treatment group than another since the difference in post-test achievement scores due to treatment interaction with abstract reasoning scores was not significant at the .05 level of confidence.

7. That the difference in post-test achievement scores due to the sex across treatment groups was not significant at the .05 level of confidence.

8. That the experimental treatment was not more effective with one treatment group than with another since the difference in post-test achievement scores due to treatment interaction with abstract reasoning scores was not significant at the .05 level of confidence.

The significance of this study is not restricted to the objective findings as revealed by the statistical analyses. The investigator discovered certain subjective advantages to the use of the advance organizers as a learning aid. It was found through subjective interviews with the subjects that all reported that the advance organizer helped them in interpreting the instructional passage and gave them insight into answering the achievement test questions. This was confirmed by asking several questions after instruction and testing was accomplished.

Twenty-three of the one hundred twenty subjects in the study reported that the advance organizers utilized were already familiar to them. From this action, it might be appropriate to speculate as to whether previous experiences influenced achievement. Since there was no real evidence as to which of the two contributions (previous experience or the advance organizer) played the major role, it would appear to be reasonable to assume that both factors played some part in achievement.

Recommendations for Further Study

On the basis of the findings and conclusions previously stated, the investigator recommends the following:

1. That similar studies be expedited to determine the effects of advance organizers at varying grade levels.

2. That similar studies be conducted to determine the method of transferability of advance organizers to learning situations.

3. That research be undertaken to investigate the effects of previous science experience upon the effective use of advance organizers.

4. That research be undertaken to determine how advance organizers may facilitate learning when students lack processing skills and the ability to organize information.

5. That additional research be carried out to determine the effects of advance organizers at differing developmental levels as prescribed by Piagetian Psychology.

6. That similar studies be undertaken to determine alternative modes of presenting advance organizers.

TABLE I

SUMMARY STATISTICS--MEAN AND STANDARD DEVIATION FOR I.Q. SCORES IN EACH TREATMENT GROUP

Treatment	Mean	Standard Deviation
Control	111.6	12.40
Audio	110.8	13.11
Written	112.4	12.26
Visual	111.6	12.43

TABLE II

ONE-WAY ANALYSIS OF VARIANCE FOR I.Q. SCORES ACROSS TREATMENT GROUPS

Source	Degrees of Freedom	Sums of Squares	Mean Squares	F
Among Treatment	3	40.73	13.58	0.086*
Within Treatment	116	18287.1	157.65	
Total	119	18327.9		

F(3,119) = 2.70

* Do not reject hypothesis. F-Value is not significant at .05 level.

TABLE III

ONE-WAY ANALYSIS OF VARIANCE FOR POST-TEST TOTAL ACHIEVEMENT SCORES

Source	Degrees of Freedom	Sums of Squares	Mean Squares	F
Among Treatments	3	590.32	196.94	1.27*
Within Treatments	116	17983.5	155.03	
Total	119	18574.3		
			F(3,119) = 2.70	

* Decision: Do not reject the null hypothesis. F-value is not significant at the .05 level of confidence.

TABLE IV

TWO-WAY ANALYSIS OF VARIANCE OF MEANS FOR TREATMENT vs. I.Q. GROUPS

Source	Degrees of Freedom	Sums of Squares	Mean Squares	F
Treatment	3	14.00	4.665	0.324
I.Q.	2	929.90	464.95 F(2,108) = 3.09	32.329*
Interaction (Treatment x I.Q.)	6	175.74	29.29 F(6,108) = 2.19	2.037**
Error	108	1553.24	14.38	

* Decision: Reject the null hypothesis. F-Value significant at the .05 level of confidence.

**Decision: Do not reject the null hypothesis. F-Value not significant at the .05 level of confidence.

TABLE V

TWO-WAY ANALYSIS OF VARIANCE OF MEANS FOR TREATMENT vs. ABSTRACT REASONING GROUPS

Source	Degrees of Freedom	Sums of Squares	Mean Squares	F
Treatment	3	4.12	1.399	0.07
Abstract Reasoning	2	429.32	214.91 F(2,108) = 3.09	10.73*
Interaction (Treatment x abstract reasoning)	6	73.64	12.27	0.62**
Error	108	2154.52	19.95 F(6,108) = 2.19	

*Decision: Reject the null hypothesis. F-value is significant at the .05 level of confidence.

**Decision: Do not reject the null hypothesis. F-value is not significant at the .05 level of confidence.

TABLE VI

TWO-WAY ANALYSIS OF VARIANCE OF MEANS FOR TREATMENT vs. SEX DIFFERENCE

Source	Degrees of Freedom	Sums of Squares	Mean Squares	F
Treatment	3	18.69	6.23	0.28
Sex	1	44.36	44.36 F(1,112) = 3.94	1.98*
Interaction (Treatment x Sex)	3	104.07	34.69 F(3,112) = 2.70	1.55**
Error	112	2514.49	22.45	

*Decision: Do not reject the null hypothesis. F-value is not significant at the .05 level of confidence.

**Decision: Do not reject the null hypothesis. F-value is not significant at the .05 level of confidence.

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